



Brief Communication

Sleep, but not other daily routines, mediates the association between maternal employment and BMI for preschool children



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ABSTRACT

Background: It has been established that the more time mothers spend working outside of the home, the more likely their preschool-aged children are to be overweight. However, the mechanisms explaining this relationship are not well understood. Our objective was to explore child sleep, dietary habits, TV time, and family mealtime routines as mediators of the relationship between maternal employment status (full-time, part-time, and no or minimal employment) and child body mass index (BMI) percentile.

Methods: Data were drawn from waves 1 and 2 of STRONG Kids, a prospective panel study examining childhood obesity among parent–preschooler dyads ($n = 247$). Mothers reported their own work hours, their child's hours of nighttime sleep, dietary habits, TV time, and mealtime routines. Trained staff measured child height and weight.

Results: Compared to working 0–19 h/week, both full-time (≥ 35 h/week) and part-time (20–34 h/week) employment predicted higher child BMI percentile 1 year later. Hours of child nighttime sleep partially mediated the association between maternal full-time employment and child BMI percentile. Adjusting for individual and family characteristics, children whose mothers were employed full time were less likely to sleep longer hours than children whose mothers were employed 0–19 h/week ($b = -0.49$, $p < 0.04$). Shorter child nighttime sleep was associated with higher BMI percentile ($b = -7.31$, $p < 0.001$). None of the other mediation pathways tested were significant.

Conclusions: These findings add to the growing literature on the importance of adequate sleep for young children's health.

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1. Introduction

In the USA, 23% of 2–5-year-old children are overweight or obese [1]. Overweight during the preschool years is of concern because it is related to overweight in later life [2], poor health [3], and stigmatization [4]. Childhood obesity is multi-determined with biological, familial, and social determinants [5]. Maternal employment is one familial factor associated with childhood obesity. The more time mothers spend working, the more likely their preschool-aged children are to be overweight [6].

Several mechanisms may explain the relationship between maternal employment and child overweight. One that has been

relatively unexplored is child sleep [7]. Parents' long work hours increased the odds of shortened child sleep for 6–7-year-old children in the Longitudinal Study of Australian Children [8]; and associations between shortened nighttime sleep and childhood obesity are well established in meta-analyses [9] and population-level studies [10].

Other daily routines (e.g., mealtime routines, frequency of family meals, time spent watching television (TV), dietary habits, and amount of physical activity) have also been suggested as mechanisms between maternal work hours and childhood obesity [11,12]. However, empirical studies testing these potential mediators are limited; only one study focused on preschool children [12]. Using two waves of data from the Longitudinal Study of Australian Children ($n = 4464$), Brown et al. [12] found that TV time partially mediated the relationship between maternal employment and child weight status among preschoolers. Among school-aged children, time spent watching TV may act as a mediator [13,14]. However, one study using a nationally representative sample found no evidence that TV viewing, bedtime, mealtime, dietary habits, or physical activity

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routines mediated the relationship between maternal employment and childhood obesity for US schoolchildren [11].

The present study adds to the literature by using two waves of panel data to examine associations between maternal employment, sleep, and other daily routines measured at wave 1 (W1), and child body mass index (BMI) measured at wave 2 (W2). We then examined total nighttime sleep, dietary habits, TV time, and family mealtimes as mediators of the relationship between maternal employment and preschooler's BMI.

2. Methods

2.1. Data and participants

Data were drawn from W1 and W2 of STRONG Kids [5], a three-wave prospective panel study on childhood obesity among preschoolers. W1 and W2 were collected 1 year apart. Parent–child dyads were recruited from 32 licensed childcare centers within a 65-mile radius of the research site and with registered capacity to serve ≥ 24 children aged 2–3 years. The response rate was 91% among centers and 60–95% among parent–child dyads within centers. Parents completed a comprehensive survey covering multilevel influences on childhood obesity. Trained staff, blind to parents' survey responses, measured children's height and weight. Parents provided informed consent and children assented prior to data collection. The analytic sample for this paper consisted of caregivers who completed W1 and W2 ($n = 291$) and met the following inclusion criteria: female aged < 65 years; biological, step, or adoptive mother to child; child aged ≥ 24 months at W1; and nonmissing maternal employment data at W1 and child height and weight measurements at W2. This yielded an analytic sample of $n = 247$. This study was approved by the appropriate Institutional Review Board.

2.2. Measures

2.2.1. Maternal employment status

Employment status was measured by mothers' self-report of the number of hours per week spent working or attending school at W1. To improve interpretability, work hours were grouped into three well-established categories reflecting typical employment options in the USA: full-time (≥ 35 h/week), part-time (20–34 h/week), and minimal or no employment (0–19 h/week) [14]. Similar categories were used in other studies [6,8].

2.2.2. Child BMI percentile

Child height and weight were measured using a digital metric scale, stadiometer, and manualized protocol. We used BMI-for-age growth charts and a program from the Centers for Disease Control and Prevention [15] to calculate BMI percentile at W2; our outcome variable. Weight status was classified as: overweight ≥ 85 th and < 95 th percentile, and obese ≥ 95 th percentile.

2.2.3. Mediators

Nighttime sleep was assessed using mothers' responses to the following, "During the past week, how many hours of sleep did your child get each night (on average)?" Nighttime sleep was assessed because it, but not daytime sleep, has been associated with child obesity [10]. Additional mediators were also assessed via mothers' reports. Child weekly intake of fresh fruits, vegetables, sugar-sweetened beverages, fast food, French fries, sweets, and salty snacks was assessed using items from the Early Childhood Longitudinal Study, Birth cohort survey [16]. Minutes the child spent watching TV on a typical weekday and weekend day were assessed using an established protocol [17]. Family mealtime organization was

assessed using five items from the Family Ritual Questionnaire [18]. All mediators were assessed at W1.

2.2.4. Control variables

Mothers reported the child's sex and age and their own sex, age, education, marital status, race/ethnicity, and annual household income. Parent BMI was calculated from self-reported height and weight (weight (kg)/(height (m)) [2]). All control variables were assessed at W1.

2.3. Data analysis

Ordinary least squares regression was used to determine longitudinal associations between maternal employment (W1) and child BMI percentile (W2). Then mediation analyses [19] were used to determine if child sleep, dietary habits, time spent watching TV, or family mealtimes mediated these associations. Sobel tests [20] were used to determine the statistical significance of indirect mediation effects. All analyses were completed using SPSS version 21.

3. Results

Most mothers in the analytic sample were employed full time (66%) or part time (18%). On average, children were reported to sleep 9.6 h per night ($SD = 1.14$). At W2, 17% of children were overweight and 12% were obese. On average, mothers were 32.4 years old ($SD = 5.43$) and had a BMI of 27.0 ($SD = 6.85$) at W1, and children were an average of 38.0 months old ($SD = 7.4$) with mean BMI percentile of 61.0 ($SD = 26.1$). Sixty-six percent of the sample had a college degree. Seventy-three percent were non-Hispanic white and another 13% were non-Hispanic Black or African-American. Fifty-four percent of the children were female.

Multivariate results indicate that maternal employment was associated with child BMI percentile. Compared to mothers working 0–19 h per week, working part time (20–34 h) and full time (≥ 35 h) predicted higher child BMI percentile 1 year later controlling for child sex and age and maternal BMI, age, education, marital status, and race/ethnicity and annual household income (see Table 1, column 1).

Children whose mothers were employed full time were less likely to sleep longer hours compared to those whose mothers were employed 0–19 h per week ($b = -0.49$, $p < 0.04$; see Table 1, column 2). Column 3 indicates that shorter child nighttime sleep hours were associated with higher BMI percentile ($b = -7.31$, $p < 0.001$).

Results shown in Column 4 suggest that child nighttime sleep partially mediated the association for both full- and part-time work such that greater maternal work hours were associated with fewer hours of child sleep, which in turn were associated with higher child BMI percentile. Specifically, inclusion of child nighttime sleep significantly reduced the coefficient for maternal full-time employment by 23.1%. Entering child nighttime sleep into the final model also reduced the coefficient for part-time employment by 24.8%.

Sobel tests were conducted to determine if these mediation pathways were significant, and they confirmed that child nighttime sleep hours partially mediated the effect of maternal employment on child BMI percentile. The mediation pathway for full-time employment was significant (Sobel test statistic 1.84, $p = 0.03$) and the mediation pathway for part-time employment was marginally significant (Sobel test statistic 1.56, $p = 0.06$). None of the other mediation pathways was significant.

4. Discussion

Using a panel study of preschool children and their parents, we found that hours of nighttime sleep, but not other daily routines, mediated the relationship between full-time maternal

Table 1

Multiple regressions testing sleep as a mediator between maternal employment at wave 1 and child BMI percentile at wave 2.

	(1) Child BMI percentile ^a			(2) Child nighttime sleep hours ^b			(3) Child BMI percentile ^a			(4) Child BMI percentile ^a		
	<i>b</i>	<i>se</i>	<i>P</i> -value	<i>b</i>	<i>se</i>	<i>P</i> -value	<i>b</i>	<i>se</i>	<i>P</i> -value	<i>b</i>	<i>se</i>	<i>P</i> -value
Child sex (Male) ^b	−2.81	(4.08)	0.50	0.11	(0.15)	0.46	−1.82	(3.98)	0.65	−2.35	(3.98)	0.56
Child age in months ^b	−0.00	(0.28)	1.00	−0.01	(0.01)	0.59	−0.10	(0.27)	0.70	−0.02	(0.27)	0.93
Maternal BMI ^b	0.66	(0.32)	0.04	−0.00	(0.01)	0.72	0.74	(0.31)	0.02	0.70	(0.31)	0.03
Maternal age ^b	0.18	(0.42)	0.67	−0.01	(0.02)	0.51	0.07	(0.41)	0.86	0.10	(0.40)	0.81
Maternal education (Less than college degree) ^b	−2.25	(5.86)	0.70	0.18	(0.21)	0.41	−2.96	(5.63)	0.60	−1.17	(5.71)	0.84
Marital status (non-two-parent) ^b												
Two-parent household	−1.38	(6.36)	0.83	0.23	(0.23)	0.32	−0.30	(6.20)	0.96	0.11	(6.19)	0.99
Annual household income (<\$25,000) ^b	−1.92	(8.47)	0.82	0.01	(0.31)	0.99	−0.51	(7.98)	0.95	−1.97	(8.22)	0.81
\$25,000–\$39,999	−7.75	(8.01)	0.33	0.28	(0.29)	0.34	−6.27	(7.68)	0.42	−5.89	(7.80)	0.45
\$40,000–\$69,999	−5.47	(8.96)	0.54	0.20	(0.33)	0.54	−2.48	(8.57)	0.77	−4.56	(8.72)	0.60
\$70,000–\$99,999	1.00	(9.52)	0.92	0.42	(0.35)	0.23	6.76	(9.01)	0.46	4.02	(9.28)	0.67
≥\$100,000												
Maternal race/ethnicity (NH White) ^b												
Hispanic	3.81	(8.81)	0.67	−0.09	(0.32)	0.95	3.21	(8.43)	0.70	4.03	(8.56)	0.64
NH Black	8.95	(6.75)	0.19	−0.94	(0.25)	0.00	2.06	(6.72)	0.76	2.53	(6.79)	0.71
NH Asian	10.41	(8.47)	0.22	−0.13	(0.31)	0.67	5.99	(7.98)	0.45	9.76	(8.23)	0.24
Other	11.59	(17.28)	0.50	−0.08	(0.63)	0.90	11.84	(16.81)	0.48	11.27	(16.78)	0.50
Maternal employment ^b												
(Employment 0–19 h)												
Full time (≥35 h)	14.03	(6.43)	0.03	−0.49	(0.24)	0.04	–	–	–	10.79	(6.31)	0.09
Part time (20–34 h)	15.76	(7.53)	0.04	−0.47	(0.28)	0.09	–	–	–	11.85	(7.40)	0.11
Child nighttime sleep hours ^b	–	–	–	–	–	–	−7.31	(1.86)	0.00	−6.82	(1.87)	0.00
Intercept	33.48	(19.08)	0.08	9.89	(0.70)	0.00	117.82	(24.54)	0.00	101.03	(26.20)	0.00

Abbreviations. *se*, standard error; *b*, estimated unstandardized coefficient; BMI, body mass index; NH, Non-Hispanic.

Categories within parentheses are reference groups. Two-parent households include married and civil union marital status; non-two-parent households include single, separated, divorced, and widowed marital status.

^a Measured at wave 2.^b Measured at wave 1.

employment measured at W1 and child BMI at W2. This suggests that mothers who are employed full time may have to wake their children earlier and/or put them to bed later than mothers who work less than full-time schedules [8]. Each additional hour of sleep was associated with a decrease of 6.4 BMI percentage points a year later. Thus, even one additional hour of sleep may promote young children's healthy weight. Educational efforts should focus on teaching parents how much sleep young children need and the benefits of adequate sleep. Additionally, educators should provide guidance about how to help children sleep through the night uninterrupted (e.g., removing televisions from the bedroom and creating a dark and quiet space for sleep) and manage time so that an early and consistent bedtime can be established.

Our finding that young children's dietary habits do not explain the impact of maternal employment on child BMI is consistent with other research [11,12]. We also found that TV time was not a mediator, whereas Brown et al. [12] found that TV time partially mediated the effect of maternal employment on child BMI for Australian preschoolers.

The inconsistent findings in the literature suggest that it may be important to consider the quality, not just quantity, of maternal employment. Future research should examine maternal employment characteristics (e.g., standard or nonstandard work schedules and the number of concurrent jobs) and their impact on child sleep and BMI. Additionally, future studies should consider the impact of paternal employment on household routines and child BMI.

Several limitations should be acknowledged. Our sample is small and nonrepresentative. Findings cannot be generalized across the USA but are relevant for families using licensed daycare in nonmetropolitan areas. We did not screen for child sleep disorders; however, no participants reported sleep apnea when asked to list their child's chronic medical conditions. Most variables were based on maternal report; working mothers may not accurately report their children's dietary habits or TV time during hours spent

in childcare. A strength is that child height and weight were objectively measured.

In conclusion, this study identifies full-time maternal employment as an important predictor of shortened nighttime sleep among preschool children. It is among the first to examine child nighttime sleep hours as a mechanism to explain the established association between maternal employment and child BMI. Among a range of behavioral mediators suggested in the literature, only child sleep mediated the association between maternal employment and child BMI. Overall, these findings add to the growing literature on the importance of adequate sleep for young children's health.

Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <http://dx.doi.org/10.1016/j.sleep.2014.08.006>.

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